Do we need a new generation of Internet standards? "New IP" and global Internet governance

SEPTEMBER 23 2020

VERY ROUGH TRANSCRIPT (if interested in helping correct, email support@isoc.live)

Milton Mueller
Welcome to the event. This is the Internet Governance Project at Georgia Tech. And we are today discussing a very interesting issue of the, um -- it's fundamental to Internet governance, and that is, of course, the Internet has succeeded because it created global compatibility among data communications at a critical time in the evolution of information technology, in the early 80s, when we were just getting LANS and personal computers, and the process of networking was being democratized. And the Internet protocols succeeded in bringing an unprecedented degree of openness and participation in global networking. But that was a very long time ago, that was some more than Well, about 40 years now, almost. And, in that time, we've seen four generations of mobile communications, telecommunications technology, we've seen massive upgrades in computer capability. And at the same time, we've seen an attempt to improve and upgrade the Internet standard, namely ipv6, which has had a gradual and very slow diffusion. So we're here today we have two distinguished experts in basic networking protocols. We have Dr. Richard Li, of Futurewei

Technologies, he's in California, and we have Andrew Sullivan, who is the President and CEO of the Internet Society. And we will have basically four parts to our discussion today.

Milton Mueller
First, we're going to discuss what the problem is what whether we need new IP or not. Then we're going to discuss some technical details about the differences in protocols and architectures. And we're going to talk about standardization venues. And finally, we're going to talk about the impact of these initiatives on global Internet Governance generally. Now, in terms of questions, we would like to go through those four parts of the discussion first, and then open it up to questions. If you want to ask a question, then please indicate that in the chat, I don't think we have a hand raised function in BlueJeans events. And my colleague, Brendan Kuerbis, who's one of the principals at the Internet Governance Project here at Georgia Tech, will try to keep track of who wants to ask the question. And we will upgrade you and invite you to turn on your microphone when that time comes. So let's get started.

Milton Mueller
Richard, why do we need a new IP? What problem does it solve? What makes current upgrades that have been happening at the IETF for 20 years, what makes those inadequate? And what's the what's the point behind this whole initiative?

Richard Li
Hello, everyone, Colombia with him and joke. I'm literally I'm delighted to be here. And it's a huge question. And because the answer is not that simple, because and we worked on this since 2015, only five years work. And we like start to publish and 2017. So everybody knows that. And I totally agree, not deny. Internet is a very successful technology, and perhaps the most successful technology ever invented of our times. It has created millions of jobs and billions of dollars of business. And we are benefit from yet. And it looks like looks like that. At least I believe it's an engine over count and temporary economic groups. But not everybody every sector benefits from the success of the Internet. That success of the Internet looks limited through that information technology, communication technology, also called ICT. There are so many other networks and applications that have not been connected to the Internet yet. For example, operational technology, or OT. OT is different from ICT in the sense that the information change between two points need to be found on the silicon KPI requirements. KPI is typically used in some compression technology like latency, packet loss, loopholed and a few others. And for some OT, they normally talk about dependability, lack of reliability, availability, integrity, maintainability, and security. So are not on like latency packet loss a part of it. So, when you send a control, for example, in factory, when you send a control command, say to stop a robot, if the command is too late, the robot may do some harm to his environment. There are some examples, though, especially in 3GPP. There are extensive technical specifications, and technical reports on that. So KPI metrics, such as latency, and packet loss ratio, must be guaranteed for ot networks, right. But commonly, OT networks and applications and devices and protocols, it appears that right now, they are rough, in roughly the same state of development and deployment, that it was in the 1990s, there were 10 to 20 Industrial protocols in use, and now them is dominating the market. And some of them are not even digitized. They're still using analog signals, so not digitized. The biggest much shell is given this then 15%, maybe it has been changed it I don't I have not followed up, at least

as of last year, the biggest machine is 15%. And the law power can protocols still in use, and mostly our proprietary or in one sector, right?

Richard Li
So, in order to expand the Internet, I mean the scope of the Internet, to that we want to converge IP, CT and OT. And so that's that we need to see if the [?] IP works or not. So we do some research and some experiment, we found that [?] IP, and it's not capable of meeting the KPI requirements to that is a problem we want to solve. So we want that Internet could be a truly pervasive and ubiquitous network that will converge all the IT, CT and OT together. So that is the problem we want to solve.

Milton Mueller
Okay, good. Richard, let me let me invite Andrew to come in and respond to that. So I hear you saying that fundamentally you concerned about OT and IT Convergence, and that there are simply networks and applications that really don't work well or won't work well. Going forward. So Andrew, what do you have to say about that?

Andrew Sullivan
Oh, well, thanks. First of all, for for hosting this. The The thing that I would say about it is that we're sometimes confusing some layers here. So this isn't really just IP that we're talking about, but actually a whole suite of protocols with IP kind of in the core of it on because IP is pretty thin. Right? Um, but I understand why that shorthand is being used. So like, you know, that's really a rhetorical point rather than a serious technical point. The the deeper question is whether whether these are really Internet applications or not, because that's actually part of the question. The the basic idea here is that is that we're looking for convergence. And one of the questions is whether people actually want to converge on some of the applications that we're talking about are designed not to use the Internet on purpose, right. They're avoiding Internet communications because they're deeply conservative, industrial sectors that want to avoid that kind of environment. And so it's not clear really whether the demand is there, whether this convergence is something that people really want to do, or whether that is something that is really valid.

Andrew Sullivan
From the point of view of the users of the technologies now, then we have the question of, you know, what the use cases are where, where the, where the users of that technology really do want that convergence? And then question is exactly as Richard laid out, I think, what are the what are the constraints on for those use cases? And I think, I think there's no question that we've seen cases where the traditional network stack that, that built the Internet doesn't work very well, the obvious example of this as it is interplanetary networks, where we've actually developed, you know, a whole alternative sort of mechanism for, for those communications, involving delay and, and disruption tolerance, because you know, if a moon gets in the way, then your signal goes away. And so you've got a, you've got to have a mechanism to recover that. So that's a great example of where a bunch of research happened that had to happen in order to understand Okay, here, we've got these use cases, the traditional IP stack doesn't work for us. So what are we going to do instead? And I think that it's entirely appropriate that if we've got these very specific use cases, we try to work on what the gaps are, what is the analysis that needs to be done in order to understand what problems it is we're trying to solve? And then we're

in a position on to, to decide, hey, is this really an extension of Internet protocols? Is this a new kind of protocol that needs to be built up an entire new stack? Do we need a new generation or what and I think that gap analysis is actually one of the things that is, is perhaps one of the biggest issues that we really need to confront in order to decide what the right approach is?

Milton Mueller
Very interesting. So, Richard, in some ways, he's suggesting that the whole idea of calling his new IP was maybe a bit of a mistake, or overreach? Or do you think we really need to talk about a new IP or sort of a migration to a new generation? Or are you talking more about a niche development of protocols more suited OT/IT?

Richard Li
Okay, so first,a short answer to yours, and whether it should be called next generation or not? That's not super important question. Actually. Just a name, actually, I really do not care. But they're going back to angels and comments and opinions. Actually, I kind of agree with him. And but I like to add some, like, give some follow up. So I'm appealing that from a new symbol that I, which I agree, actually, there are two problems or issues here. And as correctly analyzed by him. The first is that we want to converge the tea and Internet or not, right? So that's my understanding, assuming we want, can we do it with the Internet or not? If we want to do it, how can we do it right? to this, I like to like a question here. The first question that we won't get, I, it's not going to be decided by me or somebody else. appeals to me, because like a [?] especially in 3GVB, I don't remember that number, like a technical report and our technical specifications. And they really want to empower the OT to [?]. But what they do is that only in that very small segment of that network, there is a radio access network. But we knew that radio access network, and that in order for me to work, you need to connectthe base station or to call the G to the B, or G and B, to the core network, so this part, actually, right now, carriers and the service providers are using Internet to in 4g, like a MPLS [?] is widely used to connect the base station and cloning. Okay. So if we change the [?] , let's say how we like like expand or improve or how to make that part, who support the such requirements that are like a agreed in the industry and in 3GPP body How can we [?] I agree with Andrew, he will have two questions, the first is do we really want like an Internet to be a communications technology for ICT and OT, if we want it, how can we do it? So that new IP has actually already made that assumption to pose we won't have, and then how can we do it? That's my follow up to Andrew's comments.

Milton Mueller
Do you have any immediate response to that or should we move on to the...

Andrew Sullivan
Oh, I think I do, but I think it actually will bring us to the next topic anyway. So, um, so let me say this, if the, if the basic idea here is, okay, suppose that we want this, how do we do it? Um, I think the the problem that I keep struggling with a little bit is what the value of this is. That is, sometimes what we want, like the three GPP example is a good one, Oh, you've got this sort of link in this access network. And that's, that's one style of networking, and then basically, you connect on, you know, in the next hop with, with the Internet. If the idea is, we need to replace that next hop with a, you know, vertical integrated system of some kind, then, then what that is, is really a discussion about replacing the

existing Internet with the new network on maybe running them alongside each other, and then eventually cutting over to it. On the other hand, if what we're talking about is very specialized network use cases that then are going to be interconnected to one another. Well, that's just the Internet, right? It's a network that has a particular local kinds of things. And then you've got a network at the other end, and you want to interconnect them in some way. And that's actually, I mean, we had those, we've had other kinds of networks like that. And every time IP wins in those use cases, and that suggests that IP has certain properties for that kind of interconnection model that is particularly good. And and the Internet style of interconnecting in this case, is particularly useful for that. So I think that this is one of these cases where we really need to be quite clear about what gap it is, we think we're filling. And I, I feel like maybe the biggest problem that people are having in some of this discussion is that they don't know which engineering problem we're tackling. This isn't an engineering problem, it's a question of like, what the trade offs are going to be, much more on, then it starts as a governance problem, it starts as an engineering problem. It maybe has governance consequences, but the first thing we have to decide is, hey, what is the engineering problem that we're trying to tackle? Because if the problem is a very specific gap, then we can figure out how to how to how to fix that. Whereas if what this is, is a gap that involves something involving replacing, you know, very low level level layer three, or something like that protocols on the Internet, it's a bigger deal, because you know, that's all new silicon, it's all new routers, everybody's got to replace all, you know, get all new, all new equipment, and some of that stuff hasn't been invented yet. It's very easy to, you know, have the great features in the thing that hasn't been invented yet. And compare that to the sort of nasty, you know, tatty old version that you've got that's actually deployed, because you know, the future thing is always on hasn't been invented yet.

Milton Mueller
Well, then let's, let's move on to the more technical elements of this. So, Richard, how developed is a proposal? I know one of the things that frustrated me when I saw some media coverage of this new IP idea was that people were talking as if this were a fully developed protocol that China wanted to use to completely change the Internet. And then, on the other hand, I heard you and other people say, Well, this is just a research idea. So what is going on here? Is this an architecture? Or is it a protocol? What are some of the key technical areas where change should or should not be made?

Richard Li
Okay, so and it's a huge question, but first I will say don't trust media, so media, lots of misinformation and disinformation there. And it's quite misleading, and it's so unfortunate people even make like a decision and influence from the media. For example, one good friend, and he actually holds a very high, really senior position, in Cisco, he called me, and told me about that, look at the technical publications, like the [?] publications, and it's starting like 2017, and like started to publish that. So, technically, like, especially inside [?] , [?] is another [?] , they know that. And here, it's the reason we solve the problem. So the reason the OT ICT convergence is one of the problem we want to solve like, we want to maintain the integrity of the Internet. Consider that Internet as one network, maybe global one, and oh, many different networks there. And so, we wanted to add or enrich, enhance, on the functionalities of the current IP. So Andrew like made a good point that [?] say it that way, is the gap here, right? So, we found that gap, and then we want to act it and, and [?] it, like [?] and it's an extension new IP, or improve a new IP, or [?] now, or generically we call that new IP, and solve those problems there. So all the solutions are based on the [?] IP, IPv4 or IPv6, actually, both of them,

though we extend it, and we add more functionalities, or features, at that [?] . And it's called a [?] , you have a country plan, you have a [?] , we add those to that, so that later, your switch the router, can be implemented to support those capabilities, new capabilities, or services so that CT and ICT will be fully convergent.

Richard Li
So,you know that, you asked me about technical detail, do you want to talk, us about the like, the new format, or or just the [?] it really it looks like, or what? Right? So, what we do here, right? So just that thing about this, like, when the Internet, this kind of lack of work was done. It's inside the if IP in 1960s. Right? to that time, a packet is not called a packet, actually, it's called, it was called a datagram, letter, is that I send you a letter right? And somehow we mail like that. So we are using like a post office. So an IP packet or technology simulates mail system. So in mail you have an envelope. And you have letter inside, so the letter inside that becomes a payload. And the envelope becomes the header. So if you look at that IP packet, it has two portions. One is the header. The other is the payload. Payload is usually unstructured. So it's just some opaque data and a router should not know about it. The header and the routers couldn't make sense, of yet. Over so many years, like similarly in like a Korea service center, right now we know that FedEx, right,? What's the difference between FedEx and classical mail here. So, Fedex can guarantee something. Let's say I want to have a 24 hours overnight shipment, so today I send a FedEx package. Next morning my package will be somewhere. Of course, it will be subject to some physical constraints. You cannot ask for anything, for example, send my package to Santa, let's say. Some children actually do this! Send them my package to [?]. Simply you cannot through post, you can't, and then FedEx will do that. So, we compare FedEx package, and the mail system. Fedex package has one more paper, that's a [?] or something, to the user or sender actually write down your requirements, says that okay, I want this package 24 hours shipment, 3 day a shipment, or one week shipment, right? It doesn't matter. So this information is so critical for operation of FedEx system. So Fedex will deliver your package, not only like according your destination, that's what we see was address, and also this FedEx slip. So, in new IP here, we add one component, so the component is a simulation or such a Fedex slip that says that okay, in addition, I say I will send a packet from California to Andrew's home, so I put Andrew's as my destination. In addition, because, so important, I want next day, next morning, delivery. So we give the package to FedEx. So, in this sense, new IP is a simulation of Fedex. And IPv4, v6, is a simulation of the classical mail post office mail system. So that's about CT and ICT. So, if you do this, and the new IP, or IP, or extended IP, improved IP, wil have new capabilities, and it can do more, just not only connectivity and delivery. It can also support new capabilities, and so can deliver on new some requirements, these requirements coming from the sender or user.

Milton Mueller
So it's the old QoS, is it? And I've heard, I mean, is that what you mean by deterministic forwarding?

Richard Li
Deterministic forwarding, it's a terminology used in IETF, and it's an Internet layer. [?] it is. So, new IP, actually, goes beyond that. We call that high precision communication. The reason we want to call it a high precision communication? We have other reasons. Do you want me to talk about it?

Milton Mueller
Well, I don't want to get too technical here. But I think the main question, which not sure you're answering is all this worked out? Is this all developed? Have you defined it?

Richard Li
It's all that we have. Like, initially, which is the research capital analysis. That was a few years ago, I noted the conceptual on research, I would do that experimental research or some testing, also to some like, like, mathematical physical analysis, and it's a majority of our work is done. And it looks that the ideal is solid Bible, and physical implementation to on starting from this year, we are in the beginning of that we want to open up this technology when we share it with the public. And, and also possibly, it's like a standardization, because we believe that open standards and make sense of the open is a key to lead Internet to be successful. So we won't put we want to be much and say hello, on participation. Actually, it has happened. So initially, it was a really small project, like so right now. It's a fairly big and many countries, many, especially universities, and they have joined us that the independent research prototyping the publish their publications, also there are some like, dedicated conferences on those two, as I said, as added two new IP. Just imagine if you come like new IP, you cannot name next generation, I will call you out fix it. Okay. That might be simpler, fix it all the IP or not, oh, that ipv4, v6 . [?] US? That's pure IP, if you want it.

Milton Mueller
All right, Andrew, Mr. Old IP. Do you want to comment on some element of that?

Andrew Sullivan
Well, look, I think I really liked analogies. I think that analogies are extraordinarily helpful to understand most of the things that we, you know, there are new inventions, and so on, because really, you need to understand the unknown with things that you already know. And so analogies are very helpful. But I think that this particular analogy is a is really clever, but it has some, it's a little misleading. So one of the features of the Internet is that it isn't actually one network, right? It's multiple networks, it's an Internet. And what that means is that the different networks have different properties in them. Now, this is a place in which the, in which the postal analogy actually helps us, because one of the features of the postal system is that it's a cost fixed system with a standardized format. And that standardized format is delivered everywhere for generally the same price. So you've got a sort of standard postal mail and you put a stamp on the outside. And as long as it's within the service, service area of that postal system, it's a flat rate on one of the features of FedEx, of course, is that it doesn't actually go everywhere. And there are lots of places where they say they simply will not deliver on these things. And it's really a negotiation between you. Moreover, the user in this in this case has to make decisions about this. So the other piece about IP and the reason that we keep falling into the idea that the Internet is one network is because that's the user experience of the Internet. The user experience of the Internet is that it's all this big flat space and it's all just network services for you. If you have to make a choice, if you have to think about what are my use cases for for this data gram or this package. And then I'm going to send you then have to go to you know the post office or the FedEx Office or you've got to go to a box on the street and D with a little green sign is there to tell you what the today's collection has happened and Those are all things that are forced as part of the user's experience of this. So, what we have to do is tell applications, hey, you have to start thinking about what the what the needs are for your low level

traffic, in order to make a decision about which kind of network you're going to use. Well, it's not clear actually, that this is IP in any sense at all, then, because it moves hat decision about which network you've got to use in order to get the guarantees that you want out to the edge. But that, to come back to the original thing, that is precisely what the Internet originally did. If you go back to read the end to end arguments paper, one of the things that's interesting about it is that people talk about this as though it's machines, end to end, the machines are doing this. But actually, the end to end arguments paper doesn't talk about that. It talks about the applications. Applications do not have to live on a single machine. And and so the reality about this is that the endpoint in this is is the intelligence of the application, trying to make a decision about what kinds of properties it needs from the network. And what that means is you want to strip out as much intelligence as possible from the low level network protocols, because you got to implement them in the application anyway. And if that's the case, then all you really need here is a layer 3 model that just delivers a very simple sort of, I promise to get it there within this time, a deterministic networking model, and really not much more to it. And under those circumstances, we're back to the Internet model. Because in that case, the application needs to make the decisions, and all of this stuff about how the router is going to do these things. And all the rest of it is really a distraction. Because it's a question of what kind of properties the network that you're connected to is going to provide, rather than what kind of properties The Internet is going to provide. The Internet remains the, you know, best efforts networking, in order to deliver this kind of thing with this smooth end to end property. And what you've got to then have is another level of service in some sense, in order to build in order to build that up. But the application needs to know what kinds of decisions it needs to make in order to in order to use that kind of functionality. And that That, to me is a little bit different from the proposals that we've seen so far. Because many of the proposals that I've read anyway, seem to be pushing some of those decisions down into the network. They're providing sort of network services that give these kinds of guarantees. And that's not a very Internet like thing. And that's actually a conceptual difference between these two models. on that is that is not only... Sorry, go ahead

Milton Mueller
It's very fundamental this issue, I'd like to hang on this for a bit,

Andrew Sullivan
Sure.

Milton Mueller
The end to end argument. And I have seen in some discussions I've had with Huawei engineers some criticism of the end to end model and maybe, Richard, are you are you departing from that? And I think Andrew makes a very strong case for separation of the layers here, between the networking layer and the application layer. So Are you challenging that you think we need to move beyond that?

Richard Li
Yeah, it's okay. Let me come on that. So that's, that's the way we thought to have different here. Right. What Andrew said is right. With respect to what Internet is. Or what Internet was, the Internet was designed, based, therefore that globally, like used, right, that that that was true, and that continues to be true. I'm not change that. But syllables. This Internet is a system to deliver information from A to B,

right? So it's called a delivery system. And FedEx. I hate a FedEx is another type of delivery system. Post Office mail is a delivery system credits, like a service office is another delivery and system. But can we consider them as in a more generic census? Like it's a delivery system? So in our case, so my point is that we should expand the scope of Internet to cover other things. For example, right now in post office, they're all they're also provided some guarantee the services almost the exact same way as FedEx does, but maybe, you know, there are some differences right there. So here, my pointer is that we need to experiment that over the Internet in order to serve the economy industry. After all, why do we need to do this? We want to do something like a poop maker our economy grew. So that's I say that it's some I believe, the Internet right now is the engine for the economic groups. Look at the wall street lose companies like [?] every day. [?] this.Business is good, though. So it's an engine. So I want to add more gas, more fuel to this engine here, too. That is saying I genuinely are. And that's for that. So I personally agree with Andrew with respect to that classical gustavian. So that's how immunity was defined. But what we are doing is that we are expanding the scope of immunity. Just actually last year in, I gave a keynote speech in Broadcom, I told them that to come to England, and actually they've said limit, we want to go beyond that limit to cover more cases. To come back to our question I asked if I muted and saying that lives here, this application layer and network layer is true. And we have a little scale, which I believe that's obviously our immunity model defines but typically you have five layers here you have the top is application, like a news mail, like and then under that you have end to end a model that typically TCP, UDP quick, and then you have a network layer, that's hop two hop, and then you have a link layer, typically a net could be a subnet, and then optical physical layer, right. So we have five layers here, each layer is like, divided, they have visual functions. And for the disabled immunity, it works well. So because I have a TCP here, that's fine. So if you want Kevin here, where the packet to the or later cuz they'll use TCP, if you don't care if your packet is lost or not use UDP, that's fine. But when we say suppose I want to solve the problems I described earlier, like Kevin t something, and then we found that deal with sacred law, if let's say I use TCP fail to deliver my message is supposed to my packet is lost somewhere somehow. And that TCP, people said, okay, still I retransmit. But let's do a mass here, when you retransmit your packet, your latency. And it's not just simply Pappu actually is a triple like, because why after you send in a packet, you start a timer, that time we call that retransmission timer, that retransmit timer is roughly the same as a long trip time. So from a to b from B to A. So during this time, you have not received an acknowledgement, okay, this is retransmitted to you send a packet from A to B again. So that's triple back in some industrial applications. Yes, I give your packet or sorry, that's too late. So feel that using a template to deliver some say feel. So all my point is that we solve the industrial problems at the application layer and the transport layer. And it's not simply possible, this can be mathematically proven, right? So So how can we solve that we have to take a look at the network layer. So as a hot pool, hot layer, we savia so that's why we are working on network layer to improve the IP packet to instead of like a, an improving like TCP UDP transport layer, it's not.

Milton Mueller
Very interesting. You want to jump in Andrew, we're gonna have to move on to the next item, though, after.

Andrew Sullivan

Well, but I think that this, um, this highlights a point that is related, I think to other parts of our conversation, it's very slippery, which thing we're talking about here, if we're talking about specialized network, use cases where somebody really needs these kinds of guarantees, um, then it may well be the case that you've got to have a new network technology for that, because you're trying to ask for guarantees that TCP cannot provide. I'm not totally convinced that that's the case. But there, there's an engineering question there. Um, that's very different from saying, We want the Internet to be upgraded to that kind of thing. Because when I have those very tight on connectivity requirements, and so on, I've already got a situation where the applications are involved in this and so on. So it's not actually it's not actually a general purpose technology in that case, in the way that IP and TCP IP and quick and all the rest of it are intended to be. And you've got to make that we've got to make that distinction, whether that's the kind of problem we're talking about, or whether we're talking about, you know, all kinds of other stuff. The other question then is, is actually a sort of, it really is more of a governance question, which is whether we're going to pack all of these other requirements into the lower layers, and thereby make the fundamental technologies of the network have to provide these kinds of services to everybody. Because that makes for a very, you know, makes for a complete replacement of essentially all of the hardware on the Internet that we've got deployed today. The last time we managed to do a forklift upgrade on the Internet was 1983. So I don't think it's very likely that we're going to be able to do that that quickly. And so at some point, we're going to have to have some way in which this comes together with the existing IP layer. And at that point, all of the TCP IP questions come right back into play anyway. So it doesn't seem to me that we're being totally clear about this, like, which left side of this line we're living on. If this is just, you know, control networks, industrial networks, that kind of thing, then that's one set of problems, but they're constrained. There are constraints set.

Richard Li
But short follow up if you allow me.

Milton Mueller
Okay, quickly.

Richard Li
Okay. Yeah, quickly, so I'm not actually annual subroutines, you know, ponder come back to the immunity couples on booty or not. And you also like, I mentioned a gentleman who was like, network here, right? And yes, come the immunity general Cooper's, but generally, poop was another synonym. For me, that is a minimal common purpose communication. So what the Internet solves why now, for me, it's a minimal common purpose slide. So, it still depends on like, who you want to expand the scope or not. So for me, we should expand the scope. So not only to make minimum common purpose applications, we should also serve some other purposes. So either like a application, there may not be common purpose, but they are still you know, society, you know, industry and assume that the Internet will really serve them. Because if we don't want to sue them, there will be forgotten, they will be isolated, they are not going to benefit from the success, they are not going to share the success of Indonesia, Indonesia has the whales of technology, we do not want that in other parts of the society, like a Western, they own high end developer they own like a network skip. For me, I want to maintain integrity on the Internet as early an earlier Ico, so I wanted such near towards Halloween it after the assuming is such an enormous company, they are isolated, they are not part of the unit. So I won't lose

nanobots part of it. So that's a solder from like, you know, that's a different feel to the inside, as we discuss only chill to do it or not to be included on now. It was they are not included, if let's say okay, let's make decisions, which will exclude them. And then there will be no discussion. If you say, okay, we need to include them. And then we have more discussion that were more technical, or, you know, it's an engineering problem, or political problem, or technical problems solve the problem and always a chip problem or, you know, or other things by the guy that's quick follow up toy.

Milton Mueller
Okay, that's, I think that's one of the fundamental issues that we've identified is this layering and whether we're breaking or changing that model, but we need to move on. I think another question that is really interesting about this is the question of the venue in which these standardization decisions would get worked out. So it looks too much of the world as if Huawei has gone to the ITU as the primary standards organization. Although I do know that they did approach the IETF. And there's another option, of course, and that is that Huawei would just simply develop this as a standard on its own and start selling equipment in the marketplace and perhaps, eventually become a de facto standard or accepted standard by many people in the industry based on market decisions. And this really matters I mean, most of the crowd you're talking to here, Richard are probably pretty fond of and familiar with the Internet institutions, the regional Internet registries, the ICANN, the IETF and they're comfortable in that environment and there are many good things about that environment, one of its openness and its individualism if you will, not based on states or on corporations. So what, you know, is the proper venue for pursuing this pretty systematic change or upgrade in the Internet protocols.

Richard Li
The question is for me, is that right?

Milton Mueller
Both of you. Well take a crack at it, definitely.

Richard Li
Alright, so, okay, so, for me like ITU, IETF 3GPP, ETSI, they have different experts, different like participants, with different expertise coming from different places, to each SDO has its own strengths. For me, it appears that older SDOs should collaborate Because, you know, they have, you know, different strengths. So and in this particular case, maybe I'm wrong, like Andrew, Andrew is an expert, also who's a very strong leadership position, they may have different opinion. But that's my opinion. So, in the case of new IP is faced two letter IQ with song vision, our use cases, requirements, an architecture, maybe roadmap. The reason I said so is that too far a naval, I have never seen an IFC or some leadership guys, though, talking about the ITF like a vision, future roadmap. So in which you the two, whichever, what they do is that it's like a bottom up just a loose, like leadership at csail. Wait for other guys to prove something, if something makes sense. Okay, doing it. Right. So it's a it's, it's, it's another way to IQ they're collect all the opinions requirements, like so let's employ that for the protocol itself. And we should that led ITF to standardize our new IP, this is my belief. And actually, we also put in action to probably you already knew that. So that's just one stone in some people when, like, you, I choose to publish something out to people to another story. And I can show actually, me I'm personally only presenting new IP. And in iaap, that's the Internet, I take support. And I have optimized three side

meetings, mobile something, I thought some people knew that last year and early last year, we saw that so we should, because that's my like, believes that we should make a standard open the ITF to be the owner and home for new IP. So lastly, you within that file, there was a decision how we will sponsor an ITF in Vancouver, that 4 million I think that's it 107 and I was supposed to talk about new IP on Tuesday, lonely still have boxes, they belong pack, lunch, bitch sell. So and so I saw so for that one, I want the people like a thing about that, like a maybe Okay, I do that because I'm I'm doing it if like many, many times I know you're very, very well. But so the mentality is still like an information technology mentality. Me too. I was converted to ima I was an IT guy only. And since 2015, I started to consider myself to some ot industry guy. So change mentality. Tell them what's the problem? Yes. And after Vancouver meeting, we started to do that. Actually, we have done that. So that's what I'm thinking. So we should like deliver ITF to the podcast standardization. And so another Moodle has mentioned the other day, we say it's luck, just mix something sent to the product to the customer. It's a defect to them, actually, it's untrue. And from the beginning, we like invited like multiple stakeholders, including customers, from competitors, and also the academia like researchers, right? on some people join them independently, like I do the international open conferences. So that's not true. But that looks that way. Now, there are only four incumbent vendors, right. And so and it made you pick one or two, I will like vendors I'm not even thinking about like a long future Actually, I talked with the chemical engineering and CTO, he also visited me in my office, right. So we talked about that. They also showed about that. I also talked with some Cisco fellows, like, do this to them is that for them, it was a poor use if some project like so some work is for like two years for them we saw the longer right to what they do is do the macro for this year roadmap for next year to this work looks like a five or maybe 10 maybe 15 like that, it's a long way to go. So they're not interested. But they're like watch like a video and then sometime you have casual meetings and to discuss and, um, yet they know what we are doing and it's it's fully an open to on to them. So that's a question. That's a short clarification. To me. That's only said if I want stuff that's not sure after we want you to Okay, so coming back to the venue here. Just a correction, Richard, I didn't say that you were doing it. I said that that can be done. That's a perfectly viable path forward that some vendor develop their own energy. Yeah, that could come sooner. That's why they were because and success of the Internet that depends on that everyone everywhere every sector like we should a participate, contribute. And you're like I do like because as like NGOs and international web million network networks, the whole that's the new scale, the whose own of who owns yet to mix boxes, who is the user, everybody, it should be open multistakeholder. So everybody should join so so we have an open policy here. Come back to the venue here. So for me to Danny, I hope it will standardize it. But the problem it's a tricky, intriguing here is that, should I check? Like, is it willing to do it or not? Right? So I have problem with people, I could do something I go, which we all it is so busy. So our maybe 510 years, we are not going to considering any other protocol except ipv6, we are getting deeply worried. To ipv6 only 25 years, mark this show probably 20% or even less, some people told me one guy told me that like your full 40%. And no matter what, it's too small max shell, they don't see the light in the tunnel, too. This is awkward. If you're new IP can send lies we are having for sale. It's not going to be manageable. Right? So So can we like wait for like another 10 years until like ipv6 gets like a full like replacement of ipv4? I can wait. Okay, in 10 years maybe have already retired? That's fine. That's okay. Like in this chair? That's not the reason is that so you knew that you mentioned that 5g earlier. So 5g is going to enable some applications in next two or three years, probably into 2023 versus 2035. To the deployment, probably you say well, and then people will develop this new applications to new up to new applications or, you know, developer, they'd like to like a hook them to

the Internet, or the human and it's not waiting for them. So commonly in like a sec, in other parts, they're already clearly put them in Okay, if the Richard at that time I was I work with the SEC, there was a group called NGP. So, if you don't have technology, we are going to toliet in architecture, you actually are solving it by using mec that make mobile edge computing why they say that because since nothing is guaranteed, let me put my data my application closer to the base station, that closest port yours then place as a base station, you see that the [?] is proliferating? Why? Think about it. Suppose IP can solve yet Internet can solve yet. And now we need to do so to the architecture of 5g will be the same as 4g? Right now it's different. The reason partly the reason is that the fixed line technology cannot catch up with the CT technology. [?] So that's why I want to expand the scope flow minimal common pools application to like to like a wider like purpose on.

Milton Mueller
Okay, we're gonna have to we're approaching an hour and I want to let Andrew respond to this. And then we need to try to open up the questions and talk about some of the broader governance implications as well. So, Andrew?

Andrew Sullivan
So thanks, I think that sometimes the way that this issue is being discussed is as a sort of venue wars, oh, should this be in the IETF? Should this be in the ITU, whatever. And I know that there are people who are very concerned about that, about the politics of that, and I sometimes worry about it, because of course the ITU is ultimately a government's only venue. And I'm not sure that national governments are really the best place to design our future networked world. But But there's another more fundamental issue here. And this has to do with this idea about whether you need a full architecture, or whether what you need is to build on pieces that can be reused and interlock with one another in new and interesting ways. My view is that the the building block architecture is a better one. And the reason I think that is in fact, a piece of architectural document that the Internet architecture board produced some while ago. It's RFC 5218, which asks about what makes a successful protocol. And one of the most important things that they discover in that document I was not on the IV when this cell was was written, one of the most important things that they that they discovered was that the incremental deployability of a protocol is super important to its success. And in fact, ipv6 is a great example of this of this issue. It's not incrementally deployable because it's formally incompatible with ipv4. And so you basically got to stand both things up at the same time. But the properties of that kind of protocol, have a huge resistance to deployment, because there's basically no reason to deploy it unless you absolutely need it. And in the case of ipv6, nobody absolutely needed it until we ran out of ipv4 addresses. That is why big architectures tend not to be tend not to be preferred in the in the IETF. environment, not because people have an allergy to it, or because the IETF doesn't want to work on big architectures or something like that. It's because if you build the big architecture, and then you decide, oh, now we got to deploy this everywhere, what you're really talking about is a global replacement of a of a deployed system. And that's very, very hard to do. So the question here is, you know, I think it's interesting to talk about whether the ITU or the IETF is a better place to talk about architectures. But I think before we get to that thing, we should ask ourselves whether we need a global replacement architecture for the for the Internet, because if that's what we're saying, Well, you know, I think that's an interesting research project. But I don't think it's an engineering problem at all. I think the answer for that, yes. It's never going to get deployed, because nobody has the incentives to be the first mover there. It's enormously

expensive, and it doesn't have the incremental advantages. Do you never make any revenue on the on the first day? That's the real problem for people who are trying to build a business? How do they keep the thing running while they're deploying? And I think that that's, you know, a really difficult case. And that's why if these are specialized networks, it's a different story. Because specialized networks, of course, do have these properties of needing to build this thing out for just this particular use case. And we see that over and over again. And any case, I could go on about that for a long time, but rather than doing that, I'll turn this over to questions.

Richard Li
So, you ask a really big question. Can I like answer it?

Milton Mueller
Very quickly.

Richard Li
Well, okay. So Andrew said, Are we going to replace like to have a global replacement? The short answer is no. And we will change the architecture, the short answer is no. So the reason we call that new IP, actually, many years ago, we talked with the PT. And they also told me that to work on something in stay in, you know, within the kind of framework architecture, we are not so happy for that exactly in the Internet, an architectural framework. And then incremental deployability Actually, I fully agree with you here. So I'm glad that he mentioned this, because I have been asked questions about that. Like, like compatibility, like a competitor usually is a pack of water. And a completely a billion is into operability. And for the new things there to even be a failover. Everyone is the incremental deployability. Actually, we are following that. I know, I'm glad he mentioned that, too, for from what we are working on, and also customer here. Right now, as I said earlier, it's a it's like a keeper, the Internet, or even the technology catch up with the communication technology, especially in 3g, PPPoE. Two, there were two or three like examples here. One is that for the factory in factoring, normally you have a floor building, building and the building here. So that's not like always Wi Fi or like wireless. Right? So you do some lying there. So that's an enterprise network. You can deploy new IP, actually, I have a fairly big customer on for that way. So let's do that. That give us some equipment to that. So one one deployment, I also mentioned that we need some fixed line technology between GE new the p n core network or mec network here to come. Is this a fixed line network? Yes, part of the Internet, I pay an MPLS and deployed to what new IP towers is not going to replace them is to re reuse them not replacement is reuse them to that this part of network has more capabilities, more functions, more services, so that we can support the upcoming services. So that's initially and that deployment will test and that this like a deployment in this scenario is happened to be in the current imminent activity. Nothing's changed yet. So it's not you are looking for global replacement, not at all.

Milton Mueller
Okay, so let's try and move on the questions then. So Brenden, we're going to try to upgrade people who want to ask a question and then they will ask the question in a very concise manner, or I will mute them mercilessly. So indicate your willingness to ask a question In this general subject matter in the chat, and then if you want to speak, Brenden will upgrade.

Brenden Kuerbis
Melton, I also collected a couple of questions in the chat while you guys were discussing.

Milton Mueller
Okay, do you want to

Brenden Kuerbis
Issues.

Milton Mueller
Let's read those off then.

Brenden Kuerbis
Sure. So, here's a question from Laura deNardis, Why are critical applications which have been using TCP IP for decades, often in combination with SLA's from network operators, now being called over the top applications. It's interested in the rationale for this linguistic turn to describe the same thing.

Richard Li
Okay, which one of you wants to handle that Andrew or Richard, Andrew?

Milton Mueller
I'm happy to. Look, let's be perfectly honest with ourselves. Over the top was a way of describing certain kinds of network protocols that came from a regulatory environment where there was this traditional approach of control of regulating the the network service, and it's an attempt to make the network service, you know, and to apply that to the Internet and say that the network service is still regulated. Um, so that was, that's the origin of that, that the the origin of this is basically effectively an attempt to map an old time approach to how you understand the features of the network into a network that doesn't work that way. And probably not Incidentally, but I wouldn't want to impute to anybody, you know, nefarious motives, to make sure that the regulator could still collect the money from the formerly regulated service that is now effectively free. The most obvious example of this, of course, was voice, which was, at long distances, a tariff service that tended to provide lots of income for certain in certain places. And suddenly, that becomes effectively free. So that's really the point of the linguistic turn that it turns, it turns simple data from end to end into a thing that is that is regulated. I think that's different from the operational networks, that, that this technology, the vertically integrated effort is supposed to address, right? This case is really a kind of control system that really needs precise timings from end to end. And that case is one that is extraordinarily difficult to handle over over TCP IP, although it's possible because we see people doing research over that on so that's the difference between the, the, over the top and operational technology. I just wanted to make sure that the two things were not conflated, because it sounded to me and the question like they might have been.

Brenden Kuerbis
Great. Thanks, Andrew. So we have a question from Mark. Mark, I went ahead and promoted you. So if you want to go ahead and ask your question. Oh, looks like we lost Mark.

Mark
Sorry, I'm confused. This is Mark. I was just confused by the user experience. Can you hear me now?

Brenden Kuerbis
Yep, we can hear you. Go ahead.

Mark
Yeah, an observation and then a question for Richard. This is Mark [?] from Microsoft, by the way. It seems to me that the the Chinese domestic market is very huge. And also that the Chinese national government has a lot of control about you know, the, the the boundaries of the Chinese network and that they can control what happens within the Chinese national network. I mean, I know there's no such thing. But the Internet within China's borders could be substantially controlled by the Chinese government, they can set their own standards. They the market is big enough that they could mandate the creation of silicon and the replacement of hardware, etc. I mean, they could have mandated the wholesale adoption of ipv6 if they had been interested in it. So it occurs to me that the Chinese government could simply say, these new IP concepts they'll be implemented for all Chinese companies, services, government entities, etc. And then force that to exist side by side within China until the technology is mature, all the while working through the ITU, to sort of propose the concept, just say, look, we are doing the development work. Here we are prototyping it, we are doing the proofs of concept. And then during capacity building the sort of activity that happens within the United Nations, they could say, Hey, I have something that is now proven to work, would you like to do this and you know, for people who don't have a lot of capacity, that would not actually be a wholesale replacement necessarily, it could be brand new infrastructure. And so my question is, who, Richard, are you seeing an interest within, within China, either the government or other entities to take such an approach, do mandates new IP concepts within China and push them forward? Just simply in isolation? within China?

Milton Mueller
I think you've made that point. The question is, yeah, is China going to do that?

Richard Li
Thank you, Mark, thank you for your question. And I think the answer actually is larger, much larger than what I know, and larger than my expertise. And mostly I work with European customers, carriers, and companies and with them, but I have limited like knowledge about that. But even from such limited knowledges and I never heardthat the Chinese government actually, like endorses new IP on not, but that just on the contrary, you know, public ACM meeting. So I talked with some like a participants like from China, they told me that they are looking on ipv6. And so they have no idea about new IP, I think, even China, new IP still stays in the private sector. And from your from the list of customers here, and I have been working with last few years. And over them, European once.

Milton Mueller
Thank you. Yeah, I would like to follow up on that question. So as you're probably aware, that is probably an uncomfortable topic for you. But one of the reasons new IP is so controversial is that is perceived, you know, within the context of the US attack on Huawei, and exclusion of Huawei, and the

general deterioration of, and decoupling of China and the US Internet economies, this is perceived as a move to take over and fundamentally redefine the nature of the Internet. So I think what Mark was describing was a possible pathway in which China might try to do that. And do you see the the objectives of new IP as a way to sort of elevate China's role in, in global Internet Governance?

Richard Li
Absolutely not. I see that new IP from the beginning, it was designed to support the industrial applications to solve that European market initiative. Right. So start in, like, in essence, but in essence, our opinions are different than the ones that, okay, you know, it's 10th improve IP, another, like opinion instead, okay, let's do something new. That's not an IP. So we divided actually, so we worked together for a few years. So and because from that, you know, Introduction with European customers, to the prefer the new IP extension for multiple reasons, like investment protection, and also like, cost reduction, lots lots of reasons, like expertise, education, many, many reasons. So I have table meetings with some high level and executives. So it's motivated by the rule purple upstairs. So, so, the, the and also you know, that like intellectual industry 4.0 they also need something like this, right. So, it has been talked about already a few years industrial Internet. All right, we have talked about it can use well is support for the industrial Internet, particularly now. So it's a must have they are working on can make bit, isn't it? So that's the induction, isn't it? But it's not in factual Internet, right? So talk about that or not. I don't see that. On the other hand, because we have talked about that that's afraid of second IP signal, because new IP can guarantee some latency, packet loss, that kind of thing. Any state actor, no matter know who he is, or it hit yes, it's very hard for them to control my new IP packet here. The reason is that, this I'm going to bring a few more parameters to the Internet, on the Internet, it's called a link, a fairly new setup. Basically, it's just one matrix. When you fold a packet out, you look for that shortest path, but shorter paths. So that's it. After you add the more niche, together, all of a sudden, the control the Internet will be more complex dealing solve the issue. So the only solution here is the only decentralized to decentralize the control, decentralized control plan, no matter who he has this technical nature. Alright, as I said, a little like, I never gave you permission level, any knowledge like it, like a Chinese government is involved. I feel like I, it's, it's so unfortunate, actually, for me to feel some [?] . I know some media have have cooked or something.

Milton Mueller
Trying to get a better, more accurate depiction of what's going on here. I do have to say one thing I have, I have direct evidence that the Chinese government was actually ordering everybody to convert to ipv6 two years ago, and I don't know how successful that has been.

Milton Mueller
I happen to know, the one who was responsible for that project that I put in years ago. So he invited me to visit him like 10 years ago. So we talked about that. So that time we worked on ipv6 a couple years ago, I saw him on the, you know, international conference, right? That's That, to me, that is the official position, or as far as I know, is still ipv6, though. So new IP is still stays in the private sector, and how we have costs involved here. And also much more European, and companies were also involved are in the here. And then. So from the problems, we are trying to solve all of them coming from the Europe.

Milton Mueller

Okay, Andrew, do you want to get in on this?

Andrew Sullivan
Well, I, I think first of all, it's really important for me to say and really for the Internet Society, as well, to be very clear that we think that on multiple vendors, whatever the nationality of their origins, and so on, having multiple people working on the development of the of the network of the Internet and other networks, is important. And I don't think that I recognize that some of the broth around this has to do with geopolitics that are way above my paygrade. That said, there is an issue about the proposals as they exist, which have this property, that since the network has a lot more of a stake in what happens to various packets that go through it. The regulatory pinch point from the point of view of any government moves from the, you know, the devices and the applications that are under the control of the user into places where the network gets to interfere. And that's part of the reason that I keep harping on about this question, what is, you know, what are the use cases we're trying to address? If this is the industrial network? Um, you know, there are real questions about how many of that how much of that network wants to be exposed to the Internet at all, it's not always obvious that we want every industrial network to be hooked up to every other computer in the universe. So you know, that that actually has has consequences. And then at that point, maybe we've got gateways and so on. And it's a very different kind of network design. But if what we're talking about is a fundamental protocol that is going to replace the low levels are going to live alongside it, or whatever it is that we're saying is going to happen, it's going to be a low level protocol, that's going to be general purpose, and presumably, eventually would evolve into the replacement of existing IP and TCP and so on, then, it has these very different properties. And if the network has a whole lot more control over what happens to that, that has consequences for the utility of the Internet, and that and it has consequences for the utility of the Internet for humans, because it puts the control back in the power of the regulator and away from the from the edge. And we should be clear about this. There are definitely regulators in the world who do not like the Internet because it takes the power away from the network. That is definitely a position that some network regulators don't, you know, they don't talk about it very much. But it's very clear that that's a that's a position. And I think that that's one of the features of the Internet that I really like that the the control of the system is really pushed towards the edge, and it's pushed, pushed into the hands of people who can do new things with it. That's a piece that I really want to preserve. And it's one of the concerns that I have about some of the proposals that I've seen on that are underneath anything we call new IP, or virtually, vertically integrated networks or whatever.

Richard Li
Very good. I think that that is a concern that many people share. And However, it's also fair to point out that the Chinese government has done a pretty good job of controlling people and things with the existing protocol, for better or worse. Let's get another question. Is there anybody else to Brenden, who's lining up?

Brenden Kuerbis
Don't have any more hands raised. But I have a couple of questions from the chat earlier that we could probably combine. So [?] asks, should the Internet not be allowed to provide different services for different traffic? And relatedly, Ian Brown asks, What would new IP add to ipserv and diffserv?

Andrew Sullivan
So I saw the question from journalists and and I think it was directed at me. So I'll respond to that. Look, the Internet already provides differential service to various people. That's that's a fact of, of the way it's deployed today. And sometimes that is, by accident, and sometimes it's on purpose. But as Laura DeNardis who I guess, just dropped off, did point out, there are already plenty of use cases where you have good performance and latency and jitter, on commitments, about what the network is going to do. And if you are a party to one of those contracts, you spend plenty of your time and effort making sure that your vendor is in fact complying with what they promised you. That's that's a thing that people do. So that's already an existing an existing feature of the network. The question is more, the question that I would rather want to ask is, whether that is a feature that we want to make a permanent part of every network, and whether every network needs to needs to do this, or whether it's a thing that we would want most networks to provide or something like that. And that is a very different kind of question. And I still can't tell which side of the of the line we're going to land on that because that seems to me to be one of the more fundamental pieces of this part of the answer as to why we can't i can't tell that is because, you know, this is still in the research phases. It's not really a fully worked out. protocol, nevermind, a standard. And so we don't actually know which thing, which thing we're doing. And that brings us back to this question of whether comparing a theoretical future thing that hasn't been invented yet to an existing diploid thing with all the hairs all over it is is a, you know, a fair comparison. Because it it makes it difficult to do comparative, you know, analyses between an actually tawdry existing thing that's deployed all over the place with all of the history associated with it, and you know, a magical future technology that we haven't built yet. Um, the magical future always comes off better. Now, I'm not saying that this is a complete fairy tale. Of course, it isn't. There are real, there are real, real work. There's real work underneath this. And I think it's commendable. But I do think it's important for us to recognize that there are consequences to the design choices that are going to be made here. And those consequences on have, you know, have effects on what people can do with this technology that we've managed to invent. Richard was quite correct when he started, this is maybe one of the most powerful technologies people have ever invented. And I think that, you know, we want to make sure that we don't lose many of the properties that make it so special.

Milton Mueller
Um, so let me try to bring things to a close here. I want to begin by saying that, you know, the Internet Governance Project is, is all about Internet governance. And one of the key issues we and in my work in particular has highlighted is this issue of the so called fragmentation of the Internet and whether Internet was going to break apart. And three years ago, I published a book that said, you know, the layer three compatibility of IP is so powerful that we will never fragment the Internet. But what we do see is what I call alignment, in which nation states try to bring control of the Internet, in alignment with their national borders. And we have seen that happening at a pace that even exceeded my expectations, particularly with the Trump administration and their attack on our connectivity to China. So the reason the new IP discussion is so important is that if this decoupling this division, this separation between China and the US, which of course, are the two world's biggest Internet economies, if this continues, we very well could be looking at a technical fragmentation of the sort that I said would not happen, if indeed, one of the outcomes is that we get different incompatible protocols. So I think that this is a very important issue. I think that we have learned that there are fundamental principle disagreements about design, particularly around the end to end argument, but I don't think we

can see I've new IP as an attempt to completely replace the Internet. I think Richard is talking about backwards compatibility and about trying to add capabilities. So, with that background, let me give each of you a chance to give us a two or three minute wrap up, starting with Richard.

Richard Li
Right. So it's a very unfortunate idea to fragment the Internet and I don't think it's a right way to go. And personally, as I said earlier, we want to maintain the integrity of the Internet, I strongly advocate Internet that is one and only one it should be for everyone, every person every economy and every industry is for humanity right though and the Internet is the engine for our current economic world everybody benefits from it even myself, right? You didn't have like last year, so many years like I my job in in this industry, I made a lot of those design while those software right. So, we should maintain that no question about that. But and so, and regarding new IP new IP we make something that shouldn't happen and we will be very very difficult to have or if not impossible, why? Because we have some guarantee inside and if the router knows that okay, if I can live with it the practical some Well, I cannot get on here that the water will drop in the solid I cannot deliver it just when you send a package to FedEx, FedEx said like sorry, we cannot deliver yet because you seen among them, we you know, we don't have impulse buy same signal. So, new idea make the harder to do anything that try to interfere with the use slides, if we take a look at the new IP you IP favors user control, the user owns that data use that data to we empower the end user in using the Internet, right. So there are multiple techniques inside. So today is not the venue to talk about it fully, I can discuss with you and the other I truly conferences on there, right. So about this no doubt, to add that we would also mention the boot cola in Australia. So if suppose like a we have a box that can be sold to multiple like an a shield and vertical industry, that would be too good for our economy and industry for cost reduction, productivity enhancement. Right so because and something should you know the reason Internet is successful after one thing is that it's a shield, then we also [?] is shared by so many people that new IP will do the same thing I singer and also my advice or good word because I lost a lot of love and a strong position there. So my advice for you is that is that and then laterIETF, ISOC can take over that you know new IP, standardize it, make it open, and to everyone, so that this technology should not be like, just people saying new IP in China. I have a question for you. I understand it the where is it comes from, because in ITU you know ITU is a data sector and industry sector. But in order to make proposal you need to gather like a government's like approval. Maybe that's that's reason every government protects its own company. I understand it like us and other countries either. But as a research scientist, [?] , right so I like fully like promote Internet as one. I do not want Internet to be fragmented, to be like, many nets, many nets, it's a fact that is emerging, partly because Internet cannot solve the problems too, so if they too cannot kind of solve, they defy Internet. I also Internet, so many years, ossification happen, right? So okay, so time is running out. So hopefully, I have more chance to discuss with any of you, if you have more questions. Thank you very much.

Milton Mueller
And I'd like to thank you, Richard, for being willing to cooperate and participate in this event. Andrew?

Andrew Sullivan
Thanks, I also want to express my thanks, both to you and to Richard, for this conversation. I think it was really good. Um, but I think one of the things that we've discovered today is a is a sort of very deep

question about what it is we think we want out of network technologies. And one of the things that the Internet, you know, in its creation, was responding to was this issue that there were all these different kinds of networks that had different sorts of properties, and so on. And so you ended up with a very, very thin, very lightweight thing that IP, and then TCP, and UDP and some other stuff, that allowed them all to work together and yet do things independently of one another. And this led to a natural sort of, you know, Lego block, or whatever sort of architecture in which, you know, various little pieces of work together. I think that the concern that you're hearing from me about about this is that it's impossible to tell whether what we're talking about right now is going back to that model, where we've got sort of inter compatibility, but very specific, specific use cases under certain circumstances, or whether this is a common network, that that goes through everybody's, everybody's system. And those two cases have very different properties. As I saw somebody say in that in the chat, you know, it could be that we're heading backwards towards the old switched on network from the telephone age. And if that's the case, it's a very different, it's got very different properties, then particular use cases that allow those networks to interact in a way that they can provide the guarantees that are necessary for those use cases. I think figuring that out, and then figuring out which pieces of these are, in fact, things that everybody needs, is is really the critical feature that is still missing in the discussion about this. And if we could get that sorted, we'd be a long way to figuring out which venues we need to be discussing these things in who needs to work on things, whether this has any implications for IP or doesn't, and so on. I think that gap is the one that I'd really like to see filled.

Milton Mueller
All right, again, thank you, both Andrew, and Richard, for your articulate presentations and discussion today. And let me just invite the rest of our audience to subscribe to the Internet Governance projects, mailing list where you get notification of these kinds of events. And bear in mind that we're at Georgia Tech in Atlanta, and we also run educational programs on we have a master's degree in cybersecurity policy. And you can investigate those possibilities as well. So with that advertisement, I will close the event. And again, Thanks all for attending, and we look forward to continuing this conversation. Thank you very much. Thank you, Newton, and you for very constructive discussions. I hope, like Andrew said, the question that have not been discussed, I hope but we have more chances. Thank you very much. Thanks.